

A Review of
Smoking and Byssinosis

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April 1980

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A REVIEW OF SMOKING AND BYSSINOSIS

Introduction

This presentation is a review of pertinent information on byssinosis and smoking, with particular reference to the presence of symptoms among non-smokers.

1. Background

Byssinosis is traditionally related to a sensation of chest tightness occurring among cotton mill workers on Mondays (Schilling et al., 1955). Several studies have demonstrated that byssinosis occurs more frequently among smoking workers than non-smoking workers (Bouhuys et al., 1969, Schilling 1964). For a detailed analysis of byssinosis and smoking it is pertinent to realize that byssinosis is a syndrome consisting of the following clinical characteristics:

. Mill fever

only present on a few occasions when the employee commences his work in the mill

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. Chest tightness

a subjective symptom which appears on Mondays and later on other days of the week after an employment period of 5-10 years; the severity of the symptoms is graded from 1/2 to 4 (which most severe?)

. Respiratory flow function changes

deviation from normal (expected) value, present after several years of employment decline over Monday shift - also present after several years of employment - both deviation from normal baseline and decrease has been found among persons exposed to other agents than cotton dust

. Chronic bronchitis

a non-specific chronic bronchitis developing after several years at work

It is preferable when discussing the relation between smoking and exposure to cotton dust to refer to the specific symptoms listed above rather than to the general term byssinosis. In the following review, chest tightness, respiratory function changes and chronic bronchitis will be treated together, as many studies incorporate the evaluation of those symptoms.

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2. Mill fever

No extensive studies have been performed on cases of mill fever. Observations on individual cases show that the symptoms occur among smokers as well as non-smokers.

3. Chest tightness respiratory function changes and chronic bronchitis

Merchant et al. (1972) determined the extent of symptoms of chest tightness and changes in pulmonary function among 441

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1st Sep*

employees at a North Carolina yarn mill. Presence of subjective symptoms and pulmonary function decrements were combined into a "byssinosis index." The index among those exposed to higher dust levels was 1.7-1.9 in different age groups among smokers and 1.1-1.3 among non-smokers. The mean $FEV_{1.0}$ for highly exposed smokers was 76% of predicted and for non-smokers 90%. The predicted value for moderately exposed non-smokers was 102%.

Doesn't this make case against smoking?

In a later study in 22 plants in North Carolina (Merchant et al., 1973), 2,967 workers were studied, again with questionnaires for chest tightness and measurements of pulmonary function. The chest tightness symptoms were classified according to Schilling et al. (1955). When dust levels ranged between 0.5 and 2.1 mg/m^3 , grade 1/2 was found among 5.6% of the non-smokers, 7.1% of the moderate smokers and 19.6% of heavy smokers. Corresponding figures for grade 2 were 5.6, 7.1 and 29.4%.

No symptoms were found among non-smokers in mills processing wool or at dust levels below 0.2 mg/m^3 . Expected $FEV_{1.0}$ values among smokers were lower than for non-smokers and related to dust levels. The values were also lower among non-smokers exposed to cotton dust than for non-smokers exposed to wool dust or a concentration of cotton dust below 0.1 mg/m^3 .

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Regarding changes in $FEV_{1.0}$ over the shift, a slight decrease was found among non-smokers exposed to the highest dust levels ($0.5-2.1 \text{ mg/m}^3$).

Martin and Higgins (1976) conducted a survey on chest tightness symptoms and pulmonary function in 14 cotton mills with 6,631 employees. At the work place with the highest prevalence of chest tightness, grade 1/2 and 1 were found in 36% of the heavy smokers and 10% of the non-smokers. 20% of all who reported subjective symptoms were non-smokers. The respiratory function measurements in the study were not analyzed for differences between smoking and non-smoking employees.

Cinkotai and Whitaker (1978) investigated the prevalence of chest tightness symptoms among 1,057 employees at 21 cotton mills in the Lancashire area. The prevalence of symptoms was not different between smokers and non-smokers; both smoking and non-smoking employees reported symptoms of chronic bronchitis.

Jones et al. (1979) studied chest tightness symptoms and pulmonary function among 486 employees in three cotton mills. Among workers exposed to more than 5 mg/m^3 of dust, 15% of the smokers and 4% of the non-smokers had symptoms of chest tightness. The corresponding figures for dust levels $0.5-0.2 \text{ mg/m}^3$ were 4 and 2%. Neither smokers nor non-smokers demonstrated deviations from predicted $FEV_{1.0}$ values. The average $FEV_{1.0}$ decreases over the Monday shift were 40 ml for smokers and 29 ml for non-smokers.

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Grimard and Fraser (1980) studied 2,700 workers in Canadian textile mills. Respiratory function data demonstrated that the frequency of abnormal test results (deviating from expected values) was higher in smokers than in non-smokers.

In a study on Swedish cotton mill workers, subjective respiratory symptoms related to Mondays were found among 20% of the 248 interviewed persons. No relation was found between the extent of subjective symptoms and smoking habits (Haglund et al., 1980). In a continuation of this study, respiratory function was studied among workers with and without a history of subjective symptoms. Baseline values were not significantly lower than expected for smokers or non-smokers. Significant decreases in $FEV_{1.0}$ and FEV were observed among smokers over the Monday work shift; a decrease was also present among non-smokers, although it was not statistically significant (Bake et al., 1980).

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Pathological lesions in lung of non-smoking and smoking cotton mill workers were studied by Pratt et al. (1980). 565 lungs were studied, and hospital records were used to ascertain smoking history. In lungs of non-smokers, a significant association was found between dust exposure and mucus gland hyperplasia as well as goblet cell metaplasia. No association was found between emphysema and cotton dust exposure.

Lungs of Smokers?

A summary of the findings from the different studies is given in table 1.

Table 1

Schematic review of severity/extent of symptoms for byssinosis among smokers and non-smokers. S = smoker NS = non-smoker
- = no observations

| Authors | Chest tightness | | FEV _{1.0} baseline | | FEV _{1.0} shift | |
|-------------------------------|-----------------|----|-----------------------------|----|--------------------------|-----|
| | S | NS | S | NS | S | NS |
| Merchant et al., 1972 | XX | X | XX | X | XX | X |
| Merchant et al., 1973 | XX | X | XX | X | XX | X |
| Martin and Higgins 1976 | XX | X | - | - | - | - |
| Cincotai and Whitaker 1978 | X | X | - | - | - | - |
| Jones et al., 1979 | XX | X | 0 | 0 | XX | X |
| Haglund et al., 1980 | X | X | - | - | - | - |
| Bake et al., 1980 | - | - | 0 | 0 | X | (X) |

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4. Comments

All the studies reviewed demonstrate that symptoms of chest tightness are present among non-smoking cotton mill workers. Many studies demonstrate that symptoms of chest tightness are more frequent among smokers than among non-smokers. In two recent studies, however, no increased prevalence could be found among smokers. The reason for this discrepancy is not known. Possible explanations could be differences in employee turnover rates or differences in the dust exposure level. Cotton dust exposure levels were low in one of the studies where no over-representation was found in smokers (Haglund et al., 1980), suggesting that a possible threshold of synergism was not reached. Regarding pulmonary function changes, either in terms of deviations from predicted values or decreases over the working shift, effects are demonstrated among non-smokers. There is a general agreement that the effects are more pronounced among smokers.

Subjective symptoms and pathological findings indicative of chronic bronchitis also also related to cotton dust exposure among non-smokers.

Conclusion

Symptoms of byssinosis--mill fever, Monday chest tightness, respiratory function changes and chronic bronchitis--are present among non-smoking as well as smoking cotton mill employees.

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